

Research and Development of Manufacturing Technology Improvement for Advanced Uncooled Infrared Focal Plane Arrays

**Industry Day
BAA 03-04-FH
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Essential In Peace, Indispensable In War

Agenda

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|---|---------------------------|
| <ul style="list-style-type: none">• Introduction | Dr A Fenner Milton |
| <ul style="list-style-type: none">• UCIR FPA ManTech Goals/
Operational Issues/
Future Focus | Jim Brown |
| <ul style="list-style-type: none">• Procurement Process | Jane Bourne/DOI |

UCIR ManTech Goals & Objectives

- **Improve availability of small pixel UCIR FPAs**
 - **100 packaged UCIR FPAs/week/source**
 - **Anticipate requirements of > 12,000 UCIR FPAs/year by FY07**
- **Emphasis placed on 640x480 UCIR FPAs**
 - **320x240, small pixel UCIR FPAs also improved**
- **Reduce costs of packaged UCIR FPAs**
 - **8X reduction in current costs**
- **Program duration: FY03 through FY06**

UCIR ManTech Goals & Objectives

<u>AUCIR FPA ManTech Goals</u>				
<u>METRICS</u>	Baseline	4th QTR, FY04	4th QTR, FY05	4th QTR, FY06
Design resistance deviation				<u>+7%</u>
Resistance Nouniformity				<7% p-p
FPA Yield*				> 50%
Package yield				> 98%
ManHours/unit**				1.2 hrs/unit
Cycle time				4 wks
Vacuum Life				10 yrs @ CFI
Performance				< 35 mK
Cost				\$2 K/unit***
* Measured in accordance with production specification				
** Time required to fabricate, vacuum package, calibrate, and test unit after receipt of ROIC wafer				
*** At 100 units/week production rate				

UCIR ManTech Goals & Objectives

Program measures of yield are evaluated against this FPA and vacuum package production specification:

1. Array format	640x480
2. Full Frame Rate	30 Hz (required) 60 Hz (desired)
3. F/#	F/1
4. Time constant	< 12 ms
5. Pixel pitch	25.2 ± 0.2 microns
7. NEDT @ F/1.0, 300K, $\lambda_{\text{cut-on}}$	< 35 mK
8. $\lambda_{\text{cut-on}}$	≥ 8 microns
9. Dynamic Range	>78 dB
10. Operating ambient temp	233K to 333K
11. Power at 30 Hz Active:	CFI
12. Defects	CFI
12.1. Row and column	Zero
12.2.1. Single pixel	CFI
12.3. Cluster Defects	CFI
12. Reliability/Vacuum life	10 years @ CFI

UCIR FPA ManTech Clarifications

- **Delete Interface Requirements (Table 2) in PIP**
- **CFI defect specification in Table 1 will become common for all**
 - **Tiered (different quality) defect specifications requested with operational justification**

UCIR ManTech Proposal Suggestions

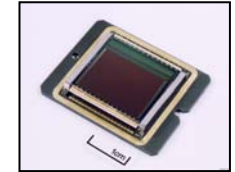
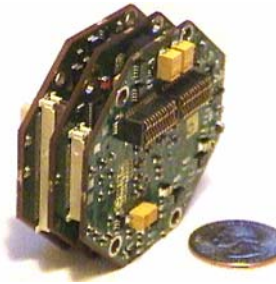
- **Technical proposals shall specifically provide for clear milestones at the end of each fiscal year with each such milestone specifically stating the work or effort to be completed and the cost of such work or effort.**
- **Each such milestone shall be considered a divisible part of the contract.**
- **Within each such milestone, there shall be a further division of specifically stated tasks and the cost for each such task.**
- **Each such task shall be a divisible part of the contract.**
- **Cost sharing is encouraged**
 - **Contractors may propose retaining residual FPAs**
- **Prioritization of all tasks in terms of largest return on investment**

UCIR ManTech Program Deliverables

- **Recommend 3 industry wide program reviews (4th qtr, 04, and annually thereafter) at RDECOM CERDEC NVESD (Ft Belvoir)**
- **Other program reviews at contractor facilities**
- **Wafer lots (640x480):**
 - **First lot and/or existing data to establish baseline**
 - **15 subsequent wafer lots (six 6” wafers/lot) minimum**
- **Deliverables to Government:**
 - **4 units from each of last two lots (8 Units)**
 - **2 units from lot 3, lot 6, lot 9, lot 12 (8 units)**
 - **Interface electronics for laboratory imaging of intermediate units**
 - **System’s (2) demo funded through the program, not GFE**
 - **No systems specs – demonstrate FPA performance**
 - **Laboratory demonstration at contractor’s facilities**

Uncooled VOx 640x480 Status

- <30 mK NETD measured
- Further NETD Improvements Expected
 - Analysis predicts 20 mK can be achieved



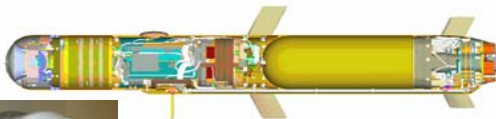
- Sponsor: US Army RDECOM CERDEC NVESD
 - Science & Technology Division
- ✓ TV equivalent resolution of 640 x 480
- ✓ Better than 1st Gen FLIR performance without cryogenic cooler
- ✓ Small detector pitch
- ✓ High Sensitivity
- ✓ Low Power - 2.5 Watts



Uncooled 640x480 Image
4.6° x 6.1° FOV



FCS OAV



Raytheon PAM Demonstrator
(320x240, 25 micron)



10 ms Thermal Time Constant



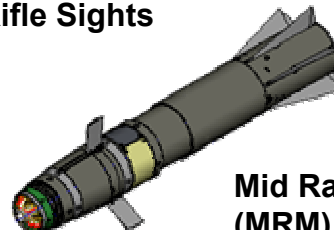
Rifle Sights



Helmet Systems



UGV



Mid Range Munition
(MRM) for FCS Block I

Driver's Viewer



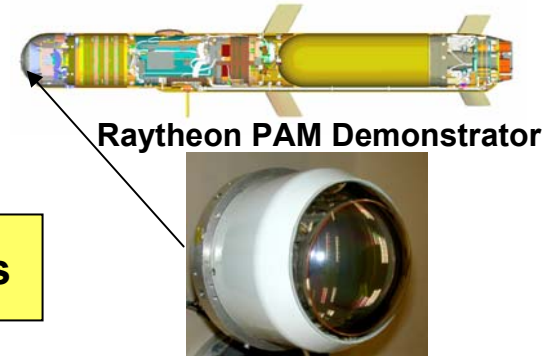
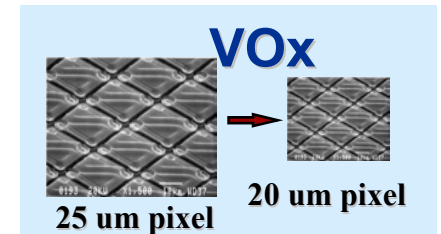
RDECOM CERDEC NVESD Applied Research Programs

- New FY04 6.2 STO (Low Cost High Resolution IR FPAs) developing very large format, Uncooled IR FPAs with 5 ms time constant and < 20 mK NETD

- AMRDEC analysis suggests required time constant for PAM Blk II, LAM Blk II, Common Missile is 5 – 10 ms & formats as high as 1920x2560

- Current PAM uses 320x240, small pixel Uncooled IR FPA
 - Time constant of PAM Blk I Uncooled IR FPA is ≈ 10 ms
 - Developed under CERDEC NVESD DUAP 98 program

Short time constant required for missile seeker applications



- FY03 6.2 STO (Low Cost Counter Reconnaissance Technology) developing reduced signature Uncooled IR sensors to reduce detection probabilities
 - New FPAs & optics components for hardened Uncooled IR cameras
 - Uncooled IR sensor signature reduction by factor of 1000 (TRL 3 \rightarrow TRL 5 by FY06)
 - cost goal: OI/OA mods < 10 % of total UCIR camera cost in production

Before



After



Significant S&T required to reduce Uncooled IR FPA time constant and reduce IR sensor optical cross section

Summary

- **Uncooled FPA Producibility program concentrates on 640x480, nominal 1 mil pixel**
- **Request prioritization of separately priced tasks**
- **Expect awards within FY03**